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ABSTRACT

This study looked at preschool and first-grade children's ability to draw script-based and text inferences in comprehension of stories they heard. In two experiments, children were asked to recall brief stories and answer two inference questions: one script inference question requiring them to fill in information about the event that was not specifically stated in the story, and a text inference question requiring them to infer relationships between story propositions that could not be inferred on the basis of event knowledge alone. In one experiment the text inference question required a propositional inference on the basis of two premise statements in the story, and in the other experiment the text inference question required an invited inference based on children's real world knowledge. Results suggested that children aged 4 to 6 years are better able to draw inferences based on schematically organized event knowledge than inferences requiring the construction of relationships between propositions not already represented in a schema. Results suggest that text inference questions are inherently more difficult than script-based inference questions and that invited inference questions are easier for children in this age group to answer than propositional inference questions. It is concluded that development of inferential processing in oral text comprehension is characterized as a progression from automatic use of a familiar schema to more purposeful deductive reasoning. (MSE)

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Filling in the gaps: Inferential processes in children's comprehension of oral discourse

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The ability to draw inferences between statements in oral discourse or presented in a text is an important part of comprehension. It is assumed that a listener or reader will infer unstated relationships in a text either on the basis of general world knowledge or as a result of logical deduction. Research on children's comprehension and memory for stories has shown that the ability to draw text inferences increases during the elementary school years. This increase is attributed to the development of deductive reasoning which is acquired during the ages 5-7 (see Paris & Lindauer, 1977 for a review).

Other research has shown that children's ability to draw inferences based on oral or written discourse depends on the type of inference required. Two basic types of inferences have been identified:- Propositional inferences are based on logical relations between story statements and are independent of context and content while invited inferences are context- and content-based and rely on an individual's prior knowledge and expectations. With age, children are better at producing both types of inferences. However, 5-year-olds perform as well as older children in drawing "invited" inferences while older children are better than younger children in drawing propositional inferences (Hildyard, 1979; Omanson, Warren & Trabasso, 1978). Thus, an important development in inferential reasoning may be the transition from reliance on real world knowledge to the ability to draw inferences which are based on information contained in a text.

These findings are consistent with research showing that children's real world knowledge about events, organized as event schemas or scripts, can improve preschool children's comprehension of script-based stories (Hudson & Nelson, 1983; McCartney & Nelson, 1979; Slackman & Nelson, 1984). An event schema is a spatially and/or temporally organized set of expectations about the order in which actions should occur in a given event. All actions and relations between actions in an event are represented in the event schema and it is argued that children's event schemas are activated whenever a familiar event is encountered or referred to and automatically guide comprehension and recall (Mandler, 1979). If this is the case, it is possible that preschool children could draw on event schemas to make inferences in comprehension of oral discourse.

To explore this possibility, the present research investigated preschool and first-grade children's ability to draw script-based and text inferences in comprehension of stories that they heard. In 2 experiments, children were read brief stories and were asked to recall the stories and answer two inference questions: a <u>script inference</u> question and a <u>text inference</u> question. Script questions required children to fill in information about the event that was not explicitly stated in the story. Text inference questions required children to infer relations between story propositions that could not be inferred on the basis of event knowledge alone.

In Experiment 1, the text inference question required children to make a <u>propositional inference</u> on the basis of two premise statements contained in the story. In Experiment 2, the text inference question required children to make an <u>invited inference</u> based on children's

real world knowledge. Although invited text inferences and script-based inferences are both made on the basis of real world knowledge, the important difference between them is that invited inferences must be constructed in comprehension while in children's event schemas relationships between actions are already represented.

We therefore predicted that children would perform better on script inference questions than on text inference questions because drawing script-based inferences does not require logical deductive reasoning. In addition, we anticipated that children would perform better on invited text inference questions than on propositional text inference questions. Whereas invited inferences are made in interpreting information according to preexisting knowledge, propositional inference require that children go beyond the application of real world knowledge in order to make logical deductions based on formal text structure.

Experiment 1

In Experiment 1, 21 four- and five-year-old nursery school children, and 20 first graders participated in the study. Children were recruited from public and private nursery and elementary schools in a middle-class community in New Jersey.

A female experimenter saw each child individually. She read 3 stories to the children and then asked them to recall the stories and answer a script inference question and a text inference question. Half of the children in each age group recalled each story before answering the questions and the remaining children answered the

questions before recalling the story. In the recall phase, children were asked to recall as much as they could from the stories and were asked "Anything else?" until they could not recall any more. Children's recall and responses to the questions were tape recorded and transcribed for analysis.

The three stories children heard were about events that young children were familiar with; McDonald's, A Day at Home, and Birthday Party. Each story contained 5 propositions. (Table 1 shows the text of the McDonald's story.) Two propositions contained premise information that was relevant for answering the text inference question. One of those premises described a particular set of circumstances which could occur in the event but that would not necessarily be specified in the general script (e.g., Johnny could not have dessert unless he ate all his dinner), while the other premise was consistent with the script for the event (e.g. eating dessert at McDonald's). Text inference questions required children to infer relationships between these propositions. For example, the text inference question in this case was "why did they have ice cream for dessert?", and the correct inference, "because Johnny ate all his dinner" is derived from integrating the information contained in the two premise statements.

Script questions required children to provide information about the event that was not specified in the story but that could be inferred from children's event schemas. In the story about McDonald's, for example, children were told that Johnny and his parents stood in line at McDonald's. The inference question, "Why did they stand in line?", required that children refer to their event

knowledge about fast food restaurants in order to derive the correct answer, "to order their food."

Results

An analysis of variance was performed on the number of story propositions children recalled (out of 5) as well as on the number of correct responses to the inference questions. The first analysis showed that first graders recalled more propositions than nursery school children, and there was also an effect of story. The McDonald's story was recalled best, followed by Birthday Party and A Day at Home. It is unclear why some stories were more memorable than others. The degree that the stories matched children's scripts may have made them easier to recall.

The mean percentages of children answering script-based and text inference questions correctly are shown in Table 2. The analysis of variance on number of correct responses to the inference questions showed that older children answered more questions correctly than did younger children and script inference questions were answered correctly more often than text inference questions. However, there was no grade by question interaction, indicating that the text inference questions were equally difficult for both age groups.

To test whether children's difficulty in answering the text inference question was simply a reflection of their ability to recall the relevant premise information, an analysis of variance was also performed on children's recall of the particular script item queried and the two premise propositions. That is, for the McDonald's story,

children had to recall "They waited in line", to receive credit for the relevant script item, and they had to recall the statements "Johnny could have not have dessert unless he ate his dinner," and "They had ice cream" to receive credit for recalling the relevant premise information. In this analysis, the only effect found was one of grade: first graders recalled more of both types of information than preschool children. Thus, children's responses to the inference questions could not be accounted for in terms of recall because there were no differences in recall of relevant script and text inference information.

Discussion

Experiment I showed that nursery school and first-grade children were better able to make inferences based on scripts for familiar events than text inferences based on propositional logic. Further, the difficulty in making propositional text inferences cannot be explained by the extra memory demands of recalling two premise propositions. Children at both ages recalled the relevant script and premise information equally well, but nonetheless, answered script inference questions correctly more often than text inference questions. These findings support the hypothesis that young children are able to infer relationships based on schematically organized event representations before they can make abstract propositional inferences.

However, older children performed better than younger children on both types of inference questions, script-based and propositional. One interpretation of these findings is that a general ability to draw inferences may develop during this age period. Another possibility is that because younger children had difficulty inferring t relationships between the two premises, they may also have had difficulty understanding the stories. Poor comprehension may have depressed their overall performance in both recalling the stories and answering inference questions. This interpretation is supported by the findings that nursery school children recalled less than two thirds of the story propositions and recalled the relevant script and premise information only half of the time.

In Experiment 2, production of script-based inferences was contrasted with invited text inferences. Because invited inferences also draw on real world knowledge, they are more easily inferred by young children and therefore may not disrupt their story comprehension. However, because the relationships between actions in an event sequence are already represented in children's scripts for the events, script-based relations should be easier to infer than even invited text inferences. Finally, if younger children are able to understand and recall the stories, they should perform as well as older children on the script inference questions.

Experiment 2

Experiment 2 included 20 nursery school children and 20 first graders in the same age ranges and drawn from the same public and private nursery schools as in Experiment I. In Experiment 2 children also heard 3 stories about events that are familiar to young children: Going to the Grocery Store, Getting Dressed and Making Cookies. The events described in these stories differed from those used in Experiment 1 because it was not possible to construct appropriate invited text inference questions about those events. As in Experiment 1, each story contained 5 propositions, one of which referred to an action or state that was not necessarily included in the script for the event. Again, script inference questions required children to provide information that was not specified in the story on the basis of their script knowledge for the event. But unlike Experiment 1, the text inference questions did not require that children infer a logical relationship between two premises. Rather, information was provided in the story that could be related to the event described on the basis of world knowledge. (See Table 3 for the text of the Going to the Grocery store story.) As shown in Table 3, the text inference question "why did they buy candy and ice cream?" requires children to relate the information that it is Susie's birthday tomorrow to buying candy and ice cream at the store in order to provide the correct answer "for Susie's birthday party". This inference is based on real world knowledge about buying party supplies and not on understanding of "if-then" relationships.

Results

As in the first experiment, analyses of variance were performed on amount recalled, number of correct inference responses, and the degree to which children recalled the relevant script and text propositions.

The first analysis showed that as in Experiment 1, first graders recalled more story propositions than preschool children. In addition, recall was better for Going to the Grocery Store and Getting Dressed stories than for Making Cookies. Although all of the stories closely followed children's scripts for the events, it has been shown that making cookies is a less frequently experienced event and children tend to recall less information from stories about less familiar events Nevertheless, children in both age groups recalled a mean of at least 3 propositions from each story. Thus, children found it easier to recall these stories than those in Experiment 1.

The percentages of children answering script-based and text inference questions correctly are shown in Table 4. Older children answered more questions correctly than younger children and script inference questions were answered correctly more often than text inference questions. In addition, while children in both age groups performed equally well in answering the script inference questions, older children performed better on the text inference questions.

There was also an event by question interaction indicating that the number of correct responses to the script and text inference questions was not significantly different for the story about going to the grocery store. Children may have found the text inference

question for this event easier to answer because it was based on the relationship between two familiar events, going to the grocery store and having a birthday party.

Finally, analysis of children's recall of the relevant script and text propositions revealed that first graders recalled more propositions overall than preschool children, but there were no interactions. This shows that, as in Experiment 1, recall of the story propositions containing information referred to in the inference questions was unrelated to children's ability to answer the inference questions correctly.

Discussion

Experiment 2 showed that children were better at drawing script-based inferences than invited text inferences. Although first graders performed better than nursery school children in answering invited text inference questions, children at both ages were equally proficient at answering script inference questions.

In addition, the ability to answer inference questions was unrelated to children's recall of the story propositions referred to in the questions. This finding provides further evidence that children's difficulty in answering the text inference questions was due to increased inferential processes required in drawing text inferences rather than any additional memory demands.

General Discussion

Together, these experiments show that children between the ages 4 to 6 are better able to draw inferences based on schematically organized event knowledge than inferences which require the construction of relations between propositions that are not already represented in a schema. Children of both ages correctly answered more script inference questions than propositional text inference questions in Experiment 1 and more script than invited text inference questions in Experiment 2.

Because propositional text inferences require that two premise statements be remembered, it could be argued that they are more difficult to infer than script inferences simply because they impose greater memory demands. This explanation was ruled out in the present study by the finding that children of both ages recalled premise information relevant to answering the propositional inference question as well as information relevant to answering the script inference question and children's ability to answer inference questions was unrelated to their recall of premise information. It appears, then, that text inference questions are inherently more difficult than script-based inference questions.

Another finding from this study is that invited inference questions are easier for children in this age range to answer than propositional inference questions. Children in both age groups were able to answer the invited text inference questions in Experiment 2 more often than the propositional text inference questions in Experiment 1. However, in the second experiment, first graders, but

not preschoolers, performed as well on invited text inference questions as on script-based inference questions.

Findings on children's overall recall of the stories provide additional evidence for the greater difficulty of propositional inferences. In Experiment 1, preschool children had relatively low overall recall scores, suggesting that their failure to draw the propositional text inferences disrupted their comprehension of the story as a whole. Poor comprehension may then have impaired recall of the story and the ability to answer both text and script inference questions.

This interpretation is supported by the findings of Experiment 2. In that experiment, preschool children recalled the stories better and their performance on the script inference question came up to the level of first graders. On the other hand, they did not perform as well as the older children in answering invited text inference question. Together, these findings indicate that preschool children can draw appropriate script inferences as well as first graders when their comprehension of the story as a whole is not disrupted.

These findings are consistent with existing research showing developmental differences in children's ability to derive text inferences. However, they also show that real world knowledge organized in the form of familiar event schemas enables preschool children as well as first graders to derive inferences about text material relating to such knowledge. To answer script-based inference questions, children need only to "read off" their event schemas which are activated automatically in comprehension. In contrast, because

text inferences must be constructed from information presented in the text, they require more effortful inferential reasoning. Invited inferences are less difficult than propositional inferences because the inferred relationship is based on familiar content, that is, real world knowledge instead of logical deduction.

Thus the development of inferential processing in oral text comprehension can be characterized as a progression from automatic use of familiar schemas to more purposeful deductive reasoning.

Table 1

Sample story text, inference questions,

and correct responses, Experiment 1

McDonald's

Johnny and his mom and dad were going to McDonald's.

(t) Johnny's father told him he could have dessert if he ate all his dinner.

(s) They waited in line.

They ate their hamburgers.

(t) And then they had ice cream.

Script inference question: Why did they stand in line?

Answer: To order their food.

Text inference question: Why did they have ice cream?

Answer: Johnny ate all his dinner.

Table 2

Percentages of children answering inference questions correctly, Experiment 1

Grade	Inference Question	Event			
		McDonald's	Day at Home	Birthday	Mean
Preschool	Script-based	55	73	59	62
	Text	50	32	11	32
First grade	Script-based	100	85	90	92
	Text	60	85	60	68

Table 3

Sample story text, inference questions,

and correct responses, Experiment 2

Grocery Store

(t) It's Susie's birthday tomorrow.

Susie and her mother go to the grocery store.

They get some candy and some ice cream at the store.

(s) Then they pay the cashier.

And they take their groceries home.

Script inference question: Why did they give money to the cashier?

Answer: To buy the groceries.

Text inference question: Why did they buy candy and ice cream?

Answer: For Susie's birthday (party).

Table 4

Percentages of children answering inference questions correctly, Experiment 2

Grade	Inference Question	Event			
		Grocery Store	Making Cookies	Getting Dressed	Mean
Preschool	Script-based	75	80	100	85
	Text	80	30	45	52
First grade	Script-based	86	91	91	89
	Text	86	62	81	76

Table 1
Story texts, inference questions, and correct responses, Experiment 1

McDonald's

Johnny and his mom and dad were going to McDonald's.

(t) Johnny's father told him he could have dessert if he ate all his dinner.

(s) They waited in line.

They ate their hamburgers.

(t) And then they had ice cream.

Script inference question: Why did they stand in line?

Answer: To order their food.

Text inference question: Why did they have ice cream?

Answer: Johnny ate all his dinner.

Birthday Party

Sarah had a birthday party.

(t) She didn't want any more dolls for her birthday.

(s) There were five candles on the cake.

Sarah blew out the candles.

(t) Then Sarah opened her presents and got some games and a doll.

Script inference question: How old is Sarah?

Answer: Five.

Text inference question: Did Sarah like all her presents? Why?

Answer: No, she didn't want any more dolls.

Table 1, continued

Day at Home

(t) On Mondays, Jane doesn't go to school.

Today, Jane put on her clothes.

Then she ate her breakfast with her mother and father.

(s) And then her father left.

(t) And Jane watched television all day.

Script inference question: Where did Jane's father go?

Answer: To work.

Text inference question: What day is it in the story?

Answer: Monday.

(s) contains information relevant to answering script inference question

(t) contains information relevant to answering text inference question

Table 2

Percentages of children answering inference questions correctly, Experiment 1

Grade	Inference Question	Event			
		McDonald's	Birthday Party	A Day at Home	Mean
Preschool	Script-based	55	59	73	62
	Text	50	11	32	32
First grade	Script-based	100	90	85	92
	Text	60	60	85	68

Table 3

Story texts, inference questions, and correct responses, Experiment 2

Grocery Store

(t) It's Susie's birthday tomorrow.

Susie and her mother go to the grocery store.

They get some candy and some ice cream at the store.

(s) Then they pay the cashier.

And they take their groceries home.

Script inference question: Why did they give money to the cashier?

Answer: To buy the groceries.

Text inference question: Why did they buy candy and ice cream?

Answer: For Susie's birthday (party).

Getting Dressed

One morning, Tim woke up.

He looked out his window to see what kind of day it was.

(s) He took off his pajamas.

Then he put on his school clothes.

(t) And then he put on his coat and mittens.

Script inference question: Why did he take off his pajamas?

Answer: So he could get dressed (for school).

Text inference question: What was the weather like that day?

Answer: Cold (or snowy).

Table 3, continued

Making Cookies

(t) Sally's friend is coming to visit her tomorrow.

Sally and her mother decided to make some cookies.

They mixed the cookie dough.

(s) Then they put the cookies in the oven.

Then they took the cookies out.

Script inference question: Why did they put the cookies in the oven?

Answer: So they could bake.

Text inference question: Why did they make cookies?

Answer: For Sally's friend.

(s) contains information relevant to answering script inference question

(t) contains information relevant to answering text inference question

Table 4

Percentages of children answering inference questions correctly, Experiment 2

Grade	Inference Question	Event			
		Grocery Store	Getting Dressed	Making Cookies	Mean
Preschool	Script-based	75	100	80	85
	Text	80	45	30	52
First grade	Script-based	86	91	91	89
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